

Left Ventricular Aneurysm Repair: A Comparison of Linear Versus Patch Remodeling

Hsiao-Huang Chang*

Division of Cardiovascular Surgery, Department of Surgery, Taipei Veterans General Hospital, Taipei, Taiwan, R.O.C.

Left ventricular (LV) aneurysm is a relatively common complication after extensive anterior myocardial infarction. Surgical repair is often indicated in patients with significant LV aneurysm. Surgical attempts to repair the result of myocardial remodeling after myocardial infarction have been attempted for more than 6 decades and there is no “gold-standard guideline” for LV aneurysm repair.¹ One of the reasons why no single operative technique can be simply and perfectly applied to all patients is that the location and size of a LV aneurysm are different in all patients. In addition, the existence and degree of septal aneurysm, and even surgeons’ experience, will influence the choice of repair techniques.

As the authors of the article published in the August 2009 issue of the *Journal of the Chinese Medical Association* have described, many different operative techniques for LV aneurysm repair have been reported.² There are 3 main types of surgical repair: linear repair, circular repair, and patch repair. Furthermore, there are even subtypes of linear and patch repairs. With regard to linear repair, Cooley et al³ were the pioneers of LV aneurysm repair. Under the support of cardiopulmonary bypass, the aneurysm is resected partially, and then the residual aneurysm wall is reinforced with Teflon felt strips and is closed with horizontal mattress and continuous running sutures.³ Many surgeons still favor this technique to repair a LV aneurysm. Several modified linear repair techniques, such as the technique by Stoney et al⁴ and Guilmet’s septoexclusion technique,⁵ have been proposed over time. However, these techniques are not often adopted because they are more technically demanding and a longer learning period is required.

There are several other disadvantages of linear repair. First, there can be distortion of LV geometry, especially for large aneurysms. Second, there is a high risk

of compromising the functional LV cavity and making the left ventricle too small. Prolonged accelerated sinus rhythm is commonly seen after such an operation, which makes postoperative care more difficult. Finally, ventricular tachyarrhythmia is sometimes complicated and can cause an unfavorable result.

Patch LV aneurysm repair has been developing since the 1980s because of the shortcomings of direct linear repair as described above. The main purpose of this type of repair is to restore the anatomical LV geometry through endoaneurysmorrhaphy with a Dacron patch. Similar to the linear repair technique, there are also several different subtypes of patch repair: the Dor procedure, the surgical anterior ventricular endocardial restoration (SAVER) procedure, and the ventricular endoaneurysmorrhaphy procedure.^{6,7} Although these procedures are a little different from each other, the concept of LV reconstruction is the same. Because viable myocardium fibers are placed in a more natural orientation, postoperative cardiac performance is more satisfactory. After patch repair, the scar tissue of the aneurysm is sutured and covered onto the patch to reinforce the strength of the patch as well as to reduce the tension of patch sutures and avoid tearing of the myocardium. This second layer structure also improves hemostasis of the ventriculotomy.

In Chen et al’s study,² surgical mortality, in-hospital mortality, mid-term results of LV ejection fraction (LVEF), and overall survival rate at 1, 5 and 10 years all showed no significant differences between the linear and patch repair groups. However, 2 interesting results reached statistical significance. First, LVEF significantly improved within 12 months of surgery. While the improvement in LVEF 12 months after surgery showed no significant difference between groups, the improvement in LVEF within 12 months was significantly different between groups. LVEF improved from



*Correspondence to: Dr Hsiao-Huang Chang, Division of Cardiovascular Surgery, Department of Surgery, Taipei Veterans General Hospital, 201, Section 2, Shih-Pai Road, Taipei 112, Taiwan, R.O.C.
E-mail: shchang@vghtpe.gov.tw • Received: August 25, 2009 • Accepted: December 11, 2009

26.3±9.0% to 28.3±7.5% ($p=0.157$) within 1 year in the linear group, and from 26.5±7.2% to 32.1±7.7% in the patch group ($p=0.001$). This finding indicates that LV function recovered faster in the patch repair group than in the linear repair group, even though the mid-term results and survival rates failed to show significant differences. The second interesting finding was the change in right ventricular ejection fraction (RVEF). In the patch group, RVEF did not significantly change within 1 year or at more than 1 year of follow-up. In contrast, RVEF deteriorated soon after surgery in the linear group (55.0±6.3% to 49.0±9.7% within 12 months, $p=0.038$), and did not return to preoperative levels after the 12-month follow-up. This finding indicated that linear surgical correction of LV aneurysm probably distorted the LV geometry, and thus jeopardized the synchronization of the interventricular septum leading to the deterioration of RV performance. Further imaging studies of both groups is recommended to clarify the cause of RV function deterioration.

Several studies have failed to show significant differences in short-term, mid-term, and long-term results between linear repair and patch repair groups.⁸ However, previous studies, including Chen et al's,² have shown a favorable outcome of the patch group compared with the linear group.⁹ Overcorrection of LV aneurysm resulting in a small left ventricle could be easily avoided by inflating a sizing balloon during patch repair.

No single technique can be safely and simply applied to all clinical settings. Each technique should be individually adapted to different patients, depending not only on the location and size of the aneurysm but also on the degree of scarring of the interventricular septum.

If the ventricular septal aneurysm is serious or the LV aneurysm is large, patch repair is preferred to restore the native LV geometry and improve LV function.¹⁰

References

1. Beck CS. Operation for aneurysm of the heart. *Ann Surg* 1944; 120:34–40.
2. Chen WY, Wu FY, Shih CC, Lai ST, Hsu CP. Left ventricular aneurysm repair: a comparison of linear versus patch remodeling. *J Chin Med Assoc* 2009;72:414–21.
3. Cooley DA, Collins HA, Morris GC Jr, Chapman DW. Ventricular aneurysm after myocardial infarction; surgical excision with use of temporary cardiopulmonary bypass. *JAMA* 1958; 167:557–60.
4. Stoney WS, Alford WC Jr, Burrus GR, Thomas CS Jr. Repair of antero-septal ventricular aneurysm. *Ann Thorac Surg* 1973; 15:394–404.
5. Calafiore AM, Gallina S, Di Mauro M, Pano M, Teodori G, Di Giammarco G, Contini M, et al. Left ventricular aneurysmectomy: endoventricular circular patch plasty or septoexclusion. *J Card Surg* 2003;18:93–100.
6. Dor V, Saab M, Coste P, Kornaszewska M, Montiglio F. Left ventricular aneurysm: a new surgical approach. *Thorac Cardiovasc Surg* 1989;37:11–9.
7. Athanasuleas CL, Stanley AW Jr, Buckberg GD, Dor V, DiDonato M, Blackstone EH. Surgical anterior ventricular endocardial restoration (SAVER) in the dilated remodeled ventricle after anterior myocardial infarction. *J Am Coll Cardiol* 2001;37:1199–209.
8. Antunes PE, Silva R, Ferrao de Oliveira J, Antunes MJ. Left ventricular aneurysms: early and long-term results of two types of repair. *Eur J Cardiothorac Surg* 2005;27:210–5.
9. Lundblad R, Abdelnoor M, Svennevig JL. Surgery for left ventricular aneurysm: early and late survival after simple linear repair and endoventricular patch plasty. *J Thorac Cardiovasc Surg* 2004;128:449–56.
10. Tavakoli R, Bettex D, Weber A, Brunner H, Genoni M, Pretre R, Jenni R, et al. Repair of postinfarction dyskinetic LV aneurysm with either linear or patch technique. *Eur J Cardiothorac Surg* 2002;22:129–34.